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Maine Agricultural Experiment Station

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NUTS AS FOOD.

This Bulletin contains the results of all available American analyses of nuts and discusses the value of nuts as a food for man.

Requests for the Bulletins should be addressed to the
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NUTS AS FOOD.

CHAS. D. WOODS and L. H. MERRILL.

While the use of nuts in this country has already attained considerable proportions, it is believed that a careful study of their food qualities would lead to their largely increased consumption. In view of their high nutritive value and the readiness and cheapness with which they may be produced, it is a matter of some astonishment that they have received so little consideration as a food and that so little attention has been devoted to their culture. This neglect is explained in part by the abundance and cheapness of cereal products, which supply our wants so fully that we have not been forced to seek foods from unusual and less reliable sources. Although, within certain limits, grain production varies from year to year, we have few more certain crops. On the other hand, the production of nuts, like that of the apple and tree fruits in general, is subject to greater fluctuations which are far less under the immediate control of man.

It is impossible to estimate with any degree of accuracy the amount of nuts consumed in this country. The following table, furnished by the statistician of the U. S. Department of Agriculture, shows only our imports. The consumption of home grown nuts must exceed these figures many fold.

IMPORTS OF NUTS INTO THE UNITED STATES.

	TWELVE MONTHS ENDING JUNE					
	1897.		1898.		1899.	
	Pounds.	Values.	Pounds.	Values.	Pounds.	Values.
Almonds.	9,644,338	$880,263	5,746,362	$659,659	9,957,427	$1,222,587
Cocoanuts.	....	471,387	....	575,935	....	625,789
All other nuts	....	848.511	....	1,002,344	....	879,166

The vast range of climatic conditions to be found in this country will enable us to grow nearly all the nuts which we now import. Some progress has already been made along these lines. Our native nuts should be improved. Nuts are subject to as many and great varietal changes as apples and are doubtless as susceptible of improvement.

THE CHEMICAL COMPOSITION OF NUTS.

It is believed that with the larger supply, the improved quality and the lower prices that would in time follow an increased demand, our American dietaries would make an important gain at a small cost. It is with a view of calling more general attention to this subject that the analyses given on the following pages are presented. Those analyses to which the fuel value is added were made at this Station. The others were compiled from various sources, as indicated in the foot-notes.

Almond. (*Amygdalus communis*).

Of the almonds consumed in the United States, by far the larger part is supplied by France, Italy and Spain. Repeated attempts have been made to grow the almond in this country, but nearly all have resulted in failure. California, however, seems to offer a promising field for this culture, and the crop of that state for 1891 was estimated at 1,000,000 pounds. As the imports for the same year amounted to about 7½ million pounds, valued at nearly $1,000,000 it may be safely predicted that our production will be largely increased.

Below is given the average of the analyses of eleven varieties of California almonds, and also four analyses of European almonds.

COMPOSITION OF THE ALMOND.

	Refuse.	Water.	Protein.	Fat.	Total carbo- hydrates.	Ash.
Edible portion:						
California almonds *a*..........	....	4.8	21.0	54.9	17.3	2.0
European almonds *b*	....	6.0	23.5	53.0	14.4	3.1
As purchased:						
California almonds	*c*64.8	1.7	7.3	19.3	6.2	.7

a. California Experiment Station Report, 1895–96; 1896–97, p. 151.

b. Koenig: Nahrungs-und Genusmittel, I, p. 608.

c. As the proportion of shell to kernel for the dry nut was not given, we have used here the proportion found in nuts purchased in the Maine market.

Brazil Nut. (Bertholletia excelsa).

As its name indicates, this nut is a native of Brazil, whence large quantities are exported. In 1897 our imports were valued at $234,972. The nut has not been successfully grown in the United States.

COMPOSITION OF THE BRAZIL NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fats.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6167	....	5.3	17.0	66.8	7.0	3.9	3,329
As purchased.........	6167	49.6	2.7	8.6	33.6	3.5	2.0	1,678

Filbert. (Corylus).

The European hazels or filberts which supply our markets are crosses and varieties of two species, *C. avellana* and *C. tubulosa.* The filbert is only sparingly grown in the United States. Our native hazels are smaller than the European nuts, though some varieties have been noted which are well worthy of cultivation.

The filbert finds its chief use as a dessert nut. In some European countries where it is produced in large quantities it is ground to a flour and used for bread. Along the Black Sea shore of Asiatic Turkey the culture of the filbert has attained great importance, the production about Trebizond in 1896 being estimated at 38,518,771 pounds.

COMPOSITION OF THE FILBERT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6170	....	3.7	15.6	65.3	13.0	2.4	3,432
As purchased.........	6170	52.1	1.8	7.5	31.3	6.2	1.1	1,644
Edible portion *a*......	......	....	7.1	17.4	62.6	10.4	2.5	

a. Koenig: Nahr. u. Genusmittel, II, p. 500. The average of two analyses.

Hickory-nut.

The hickory-nut best known to our market is the fruit of the shag-bark hickory, *Hicoria ovata* Britton. Like the other hickories, it is a native of America. It has a wide range, being found from southern Maine, west to Minnesota, and south to Texas and Florida. It is said to reach its best development west of the Alleghanies.

The quality of the nut is exceedingly variable, both as to the flavor of the kernel and the readiness with which the shell can be removed. The better varieties are highly esteemed and by many are considered the best of our American nuts, for delicacy of flavor comparing not unfavorably with the English walnut. The price is as variable as the quality, ranging, at the place and time of harvest, from 20 cents to $3.00 per bushel.

COMPOSITION OF THE HICKORY-NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6171	....	3.7	15.4	67.4	11.4	2.1	3,495
As purchased	6171	62.2	1.4	5.8	25.5	4.3	.8	1,321

Pecan. (*Hicoria pecan*).

The pecan is also a native of America, but is far less widely distributed than the species last described (*Hicoria ovata*), being found from Indiana to Iowa on the north to Tennessee and Texas on the south. It thrives best in the rich, moist soils along the river banks. Although some of the largest and best pecans are grown in Louisiana, a large proportion of those placed upon the market are from Texas, where its culture has attained considerable importance.

The flavor of the pecan makes it a desirable nut, but it owes much of its popularity to the thinness of its shell and the consequent ease with which it may be removed. These qualities adapt it especially to dessert purposes. Large quantities of this nut are used by confectioners, the shelled meats in halves selling at 30 to 40 cents per pound.

COMPOSITION OF THE PECAN.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pecans, polished:								
Edible portion	6174	....	3.0	11.0	71.2	13.3	1.5	3,633
As purchased	6174	53.2	1.4	5.2	33.3	6.2	.7	1,700
Pecans, unpolished:								
Edible portion	6173	....	2.7	9.6	70.5	15.3	1.9	3,566
As purchased	6173	46.3	1.5	5.1	37.9	8.2	1.0	1,915

English Walnut. (*Juglans regia*).

In the United States the walnut has been successfully cultivated in the Central and Southern Atlantic States, in California, and Oregon. In California the culture is especially successful, the product for 1898 being estimated at eight million pounds.

COMPOSITION OF THE WALNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, det.
California soft shell, J. regia, 4 analyses *a*.								
Edible portion	.....	.....	2.5	16.6	63.4	16.1	1.4	
As purchased	.....	58.1	1.0	7.0	26.6	6.7	.6	
California bijou, J. regia *a*.								
Edible portion	.....	.....	2.5	18.4	64.4	13.0	1.7	
As purchased	.....	73.1	.7	4.9	17.3	3.5	.5	
Italian, J. regia.								
Edible portion	6212	.....	4.0	16.9	68.0	9.0	2.1	3,538
As purchased	6212	57.8	1.7	7.1	28.7	3.8	.9	1,493
Juglans regia, 4 analyses *b*.								
Edible portion	.....	.....	7.2	15.8	57.4	17.6	2.0	
California native black, J. California *a*.								
Edible portion	.....	.....	2.5	24.9	54.7	16.1	1.8	
As purchased	.....	74.1	.6	6.4	14.2	4.2	.5	
California grown American black, J. nigra *a*.								
Edible portion	.....	.....	2.5	30.3	57.8	7.4	2.0	

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a. Calif. Expt. Station, Bulletin 113, p. 12.

b. Koenig: Nahr. u. Genusmittel, II, p. 500.

Although Asiatic in its origin, this is commonly spoken of as the English walnut. Owing to its general excellence it early won its way to popular favor, having been distributed through nearly all Europe, reaching England as early as the middle of the sixteenth century.

Chestnut. (*Castanea dentata*).

The American chestnut has a wide geographical range, being found in nearly every state east of the Mississippi, from southern Maine to the Gulf. It seems to thrive best on high lands, with light and even sandy soils. Both the European and Japanese chestnuts are also cultivated here to some extent; neither of them yield nuts of as good quality as our native stock, though both excel our nut in size.* The price of the native nut varies from $1 to $10 per bushel, according to locality, abundance and excellence of the nut.

In France, where the chestnut is widely grown, the nut has come to play an important part in the dietaries of the poor. The common way of preparing the nuts is to remove the shells and steam them, when they may be eaten either with salt or milk, furnishing a cheap and nutritious food. Thus prepared, the hot nuts are sold in the streets, and form the chief morning dish for a large proportion of the working classes. Large quantities of the nuts are also dried and ground to a flour, which can be kept for some time without deteriorating. This flour, mixed with water and baked in thin sheets, forms a heavy, but sweet and nutritious cake. The use of the chestnut is not confined to the poor, since it is used in many forms by the well-to-do classes who prepare from them many palatable side dishes.

In Italy the use of the chestnut is also very general. The nut is eaten fresh, boiled and roasted, or as a substitute for corn meal in the "polenta," a form of porridge much used by the poorer classes. A common delicacy in the Apennines is "necci," flat cakes of chestnut flour and water, baked between hot, flat stones, with chestnut leaves between the cakes.† In Korea the chestnut is said almost to take the place which the potato occupies with us, being used raw, boiled, roasted, cooked with meat, or dried whole.

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* Nut culture in the United States, U. S. Department of Agriculture, p. 82.

† Knight: Food and Its Functions, p. 199.

The chestnut differs widely from the other common nuts, since it contains much less oil and protein and much more of the carbohydrates, especially starch, which is almost wholly wanting in many nuts. It is thus a far less concentrated and better balanced food than our other nuts. The high prices which prevail in our Maine markets will prevent its very general adoption. A large and steady demand would in time lead to an increased production and ultimately to lower prices.

COMPOSITION OF THE CHESTNUT.

Variety and condition.	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.
Edible portion:							
Numbo, fresh *a*	......	.....	42.2	6.1	6.6	43.3	1.8
Moon's Seedling, fresh *a*	......	....	41.7	6.3	6.4	43.8	1.8
Solebury, fresh *a*	......	....	29.2	6.7	8.3	54.0	1.8
Native, fresh *a*	......	....	34.4	8.0	10.8	45.1	1.7
Italian, fresh *b*	......	....	53.8	6.6	2.0	36.9	.7
Italian, fresh *b*	......	....	52.7	4.1	2.0	40.4	.8
Variety unknown, fresh *c*	......	....	44.9	7.3	8.0	38.3	1.5
Average, fresh nuts	......	....	42.7	6.5	6.3	43.1	1.4
Spanish, dry *a*	.....	....	6.6	9.0	6.6	75.0	2.8
Paragon, dry *a*	......	....	6.5	11.4	9.1	70.1	2.9
Spanish, dry *a*	.....	....	5.4	10.3	9.1	72.5	2.7
Native, dry *a*	......	....	4.8	11.6	15.3	65.7	2.6
Average, dry nuts	......	....	5.8	10.6	10.0	70.8	2.8
As purchased:							
Numbo, fresh *a*	......	11.5	37.3	5.4	5.9	38.3	1.6
Moon's Seedling, fresh *a*	.....	14.3	35.7	5.4	5.5	37.5	1.6
Solebury, fresh *a*	......	15.3	24.8	5.7	7.0	45.7	1.5
Native, fresh *a*	......	23.2	26.4	6.2	8.3	34.6	1.3
Italian, fresh *b*	......	15.4	45.5	5.6	1.7	31.2	.6
Italian, fresh *b*	.....	15.5	44.5	3.5	1.7	34.1	.7
Average, fresh nuts	......	15.9	35.7	5.3	5.0	36.9	1.2
Spanish, dry *a*	......	21.5	5.2	7.0	5.2	58.9	2.2
Paragon, dry *a*	......	23.9	5.0	8.7	6.9	53.3	2.2
Spanish, dry *a*	......	25.3	4.0	7.7	6.8	54.2	2.0
Native, dry *a*	......	22.9	3.7	8.9	11.8	50.7	2.0
Average, dry nuts	......	23.4	4.5	8.1	7.7	54.2	2.1

a Penn. Expt. Station, Bulletin 16, p. 15.

b Calif. Expt. Station, Report 1895-6; 1896-7, p. 153, Bulletin 113, p. 7.

c Mass. State Expt. Station, Report, 1893, p. 354.

Peanut. (*Arachis hypogæa*).

The peanut, although not a nut in the botanical sense, is for convenience here included. It is extensively grown in at least four continents—Asia, Africa, North and South America—and has been so long and so widely cultivated that some doubt exists with regard to its origin. It is now generally regarded as a native of Brazil, although even in that country it is unknown in its wild form. Prior to 1865 the United States imported large quantities of peanuts from Western Africa. Since that date the home production has enormously increased until at the present time our crop is estimated at 4,000,000 bushels, about one-seventh of the crop of the world. Of this amount Virginia, North Carolina and Tennessee produce by far the larger part. The culture is not as profitable as formerly, since, through injudicious methods of cultivation, the previous yield of 50 or more bushels per acre has fallen to less than one-half that amount, while the cost of cultivation remains practically the same.*

There is but little waste in peanut production. The dried vines are used as hay, while the pods and low grades of the nuts are also fed to stock. Probably three-fourths of the peanuts themselves are retailed in the roasted form. A part of the cheaper grades is used by confectioners. In Europe, and to a much more limited extent in this country, the oil is extracted. This oil, forming from one-third to one-half of the kernel, is clear, sweet and palatable, for many purposes fully equal to the more costly olive oil. Indeed, much that is sold as olive oil is either peanut oil, or contains a large admixture of the same. The high grades are used in Germany as a salad oil; while the lower grades find ready use as lubricants or are employed in soap making. Although the American peanut is larger and more palatable than the African, the latter furnishes a better oil.

As a food for man, the peanut has a high claim upon the popular favor. There seems to be no reason why it should not be considered as a regular article of diet and be placed in some form upon our tables. If the cake remaining after the extraction of peanut oil be ground to a fine powder, it furnishes a flour from which a nutritious bread can be made. Attempts made in Germany to utilize this flour in the preparation of army bread have not been altogether successful, but the matter is worthy of farther trial.

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*Farmers Bulletin, No. 25.

COMPOSITION OF THE PEANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Total value per pound, determined.
Edible portion:								
Georgia peanut *a*	.....	.....	12.9	26.6	37.6	21.0	1.9	
Spanish peanut *a*	.....	.....	13.2	27.9	35.8	20.7	2.4	
Variety unknown *b*	.....	.....	4.9	29.1	48.8	15.3	1.9	
Variety unknown	6213	.....	6.0	28.1	45.7	17.8	2.4	3,008
Varieties unknown, 8 anal. *c*	.....	.....	6.9	27.7	45.8	17.0	2.6	
Average, 12 analyses	.....	.....	7.7	27.8	44.5	17.6	2.4	
Roasted peanut	6214	.....	1.6	30.5	49.2	16.2	2.5	3,177
As purchased:								
Georgia peanut *a*	.....	27.0	9.4	19.4	27.5	15.3	1.4	
Spanish peanut	...	22.0	10.3	21.8	27.9	16.1	1.9	
Variety unknown *b*	.....	28.8	3.5	20.7	34.7	10.9	1.4	
Variety unknown	6213	28.0	4.3	20.3	32.9	12.8	1.7	2,166
Average 4 analyses	.....	26.4	6.9	20.6	30.7	13.8	1.6	
Roasted peanuts	6214	32.6	1.1	20.6	33.1	10.9	1.7	2,141
Peanut butter *d*	....	.....	2.1	28.7	46.4	18.8	*f* 4.0	
Peanut butter *e*	.....	.....	2.0	29.9	46.7	15.4	*g* 6.0	

a. Georgia Expt. Station, Bulletin 13, p. 64.
b. North Carolina Expt. Station, Bulletin 90 B, p. 10.
c. Koenig: Nahr. u. Genussmittel, II, p. 500.
d. From the Atlantic Peanut Refinery, Philadelphia.
e. From the Peanolina Company, New Haven.
f. Including salt 3.2 per cent.
g. Including salt 5.0 per cent.

Acorns. (Quercus).

The only analysis here given is of the fruit of the common black oak of the desert regions of Arizona (Q. *Emoryi*). The acorns of this species are generally known as "biotes." With this analysis is given that of a sample of acorn meal and a bread prepared from the same. Acorns in the natural state are unfit for human food on account of the large amount of tannin which they contain. The meal and bread here reported were prepared by the Indians of California who by some means succeed in removing the tannin. While the meal was found to contain 6.63 per cent tannin, only a trace was discoverable in the bread. Both meal and bread were sour and sodden when received.

The Indians of the Yosemite Valley make a porridge by stirring up acorn meal with water. This is cooked by dropping in heated stones. The cooked porridge thickens on cooling, when it is sliced and browned before the fire.

COMPOSITION OF ACORNS (QUERCUS EMORYI), ACORN MEAL, AND ACORN BREAD.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Food value per pound, determined.
Acorn, edible portion	6193	....	4.1	8.1	37.4	48.0	2.4	2,718
Acorn as received ...	6193	35.6	2.6	5.2	24.1	30.9	1.6	1,750
Acorn meal..........	6184	....	8.7	5.7	18.6	65.0	2.0	2,265
Acorn bread	6185	....	60.3	2.2	9.9	27.0	.6	2,347

Beechnut. (*Fagus Americana*).

The beech is a common forest tree over the eastern half of the United States. The nuts are sweet and among the best of our wild nuts. They are widely gathered by children; but owing to the fact that the tree is an irregular bearer, the nuts small and prime favorites with the squirrels, only a very limited amount of this nut reaches the market. The prices are as variable as the supply, ranging from 10 to 60 cents per quart.

COMPOSITION OF THE BEECHNUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined,
Fagus Americana:								
Edible portion......	6166	....	4.0	21.9	57.4	13.2	3.5	3,263
As purchased	6166	40.8	2.3	13.0	34.0	7.8	2.1	1,932
Fagus sylvestris[a]....								
Edible portion......	....	....	9.1	21.7	42.4	22.9	3.9	
As purchased	....	33.0	6.1	14.5	28.4	15.4	2.6	

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[a] Koenig: Nahr. u. Genussmittel, II, p. 500.

Butternut, Oil-nut, White Walnut. (Juglans cinerea).

The butternut is found over a large part of the eastern, middle and northern states, though it is most abundant and reaches its highest development in the Ohio River basin. It is not a forest tree, but occurs most frequently in isolated positions and along fences. It is very prolific, single trees sometimes yielding 15 or 20 bushels.

Although a common nut in this State, it is not often found in the Maine markets. In the West it is more frequently met, the price ranging from 20 cents to $2 per bushel. When green the nuts are sometimes used for pickling. The thick dense shell of the ripened nut, its extreme oiliness with a tendency to become rancid, make this one of the least desirable of our nuts.

COMPOSITION OF THE BUTTERNUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6168	....	4.5	27.9	61.2	3.4	3.0	3,371
As purchased.........	6168	86.4	.6	3.8	8.3	.5	.4	458

Cocoanut. (Cocos nucifera).

Although large quantities of these nuts are annually imported into the United States, the home product is now considerable. During the past 20 years large numbers of trees have been planted in southern Florida, where it is estimated that there are at least 250,000 trees, over ten per cent of which are in bearing. The products of the cocoanut palm are so many and varied and find such ready application, that it may be long before our home production will satisfy the growing demand.

"The small, green and immature nuts are grated fine for medicinal use, and when mixed with the oil of the ripe nut it becomes a healing ointment. The jelly which lines the shell of the more mature nut, furnishes a delicate and nutritious food. The milk in its center, when iced, is a most delicious luxury. Grated cocoanut forms a part of the world renowned East India condiment, curry. Dried, shredded (desiccated) cocoanut is an important article of commerce.

"From the oil a butter is made, of a clear, whitish color, so rich in fat, that of water and foreign substances combined there are but .0068. It is better adapted for cooking than for table use. At present it is chiefly used in hospitals, but it is rapidly finding its way to the tables of the poor, particularly as a substitute for oleomargarine." *

COMPOSITION OF THE COCOANUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6169	....	14.1	5.7	50.6	27.9	1.7	2,986
As purchased..................	6169	*a*48.8	7.2	2.9	25.9	14.3	.9	1,529
Without milk, as purchased ..	6169	*b*37.3	8.9	3.6	31.7	17.5	1.0	1,872
Cocoanut milk, as purchased .	....	....	92.7	.4	1.5	4.6	.8	97
Shredded cocoanut *c*	....	....	4.3	6.5	63.7	24.1	1.4	
Shredded cocoanut *d*	....	....	2.8	6.0	51.0	39.0	1.2	
Edible portion *e*...............	....	....	5.8	8.9	67.0	16.5	1.8	
Cocoanut milk *f*..............	....	....	91.5	.5	.1	6.8	1.2	

a Milk and shell. *b* Shell only. *c* Storrs Expt. Station. *d* New Jersey Expt Station. *e* Koenig, Nahr. u. Genusmittel, II, 500. *f* Ibid, I, 495.

The meat of the cocoanut is poor in protein, as compared with most of the nuts here reported, and the milk contains about one-tenth the protein and less than one-half the fat found in the milk of the cow.

The Litchi, Leechee, or Chinese Nut. (*Nephelium litchi*).

This fruit is a native of China. It is not a true nut, although commercially classed as such. The imports to this country are quite small, and the consumption for the most part confined to the Chinese population. As the analysis indicates, it differs widely from true nuts, being very low in protein and fats and correspondingly high in carbohydrates. It finds its way to our markets only in the dried form. When fresh it is said to be one of the finest of Chinese fruits, having a white flesh with the taste of the best grapes.†

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* Nut Culture in the United States, p. 98–99.

†Popular Science Monthly, XXVIII, p. 574.

COMPOSITION OF THE LITCHI NUT.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Edible portion	6172	....	17.9	2.9	.2	77.5	1.5	1,453
As purchased........	6172	41.6	10.5	1.7	.1	45.2	.9	849

Pine Nuts. (*Pinus*).

The seeds of three species of pine have been analyzed, *Pinus edulis* Engel., *P. monophylla* Torr. and Frem., and *P. Sabiniana* Doug.

COMPOSITION OF PINE NUTS.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
Pignolias, edible portion *a*.........	.....	......	6.4	33.9	49.4	6.9	3.4	
Pinon, (P. monophylla):								
Edible portion.....................	6211	.....	3.8	6.5	60.7	26.2	2.8	3,327
As purchased.............	6211	41.7	2.2	3.8	35.4	15.3	1.6	1,940
Pinon, (Pinus edulis):								
Edible portion	6177	.....	3.4	14.6	61.9	17.3	2.8	3,364
As purchased...........	6177	40.6	2.0	8.7	36.8	10.2	1.7	1,988
Pinon, (P. sabiniana):								
Edible portion	6192	.....	5.1	28.1	53.7	8.4	4.7	3,161
As purchased.	6192	77.0	1.2	6.5	12.3	1.9	1.1	727

"The several species of pine yielding edible nuts are found on the Pacific Slope of the United States and in Colorado, New Mexico, Arizona and Mexico. The nuts are but little known to a majority of the people of the United States, though they are marketed in large quantities in some of the cities of California.

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a From Bulletin 28 of the office of Experiment Station.

Some of them are of good size for dessert or confectionery purposes, and in quality and flavor are so superior that their general introduction will doubtless make them very popular.—Along the borders of Mexico the nuts are called "piñons," and to an increasing extent this name is being accepted as applicable to all pine nuts. The pine nut has a rich, marrowy kernel in a shell that varies in thickness from that of a chestnut to that of a hard-shelled hazel nut." *

Pistachio. (*Pistacia vera*).

This nut, although a native of Syria, has long been cultivated in Southern Europe, where it produces a fruit somewhat larger than that of the parent stock, but of a less desirable flavor. Most of the nuts used in the United States are from European countries bordering upon the Mediterranean. The pistachio was introduced into the Southern States nearly half a century ago and has been somewhat widely though not extensively grown. Small quantities of this nut have been successfully grown in California.

The kernel is greenish in color and has a somewhat mild but pleasing and characteristic flavor, suggestive of almonds. In this country it finds its largest use in the manufacture of confectionery, for which purpose it is valued both for its flavor and color.

COMPOSITION OF THE PISTACHIO.

	Laboratory number.	Refuse.	Water.	Protein.	Fat.	Total carbohydrates.	Ash.	Fuel value per pound, determined.
First quality, edible portion..	6175	....	4.2	22.3	54.0	16.3	3.2	3,235
Second quality, edible portion	6176	....	4.3	22.8	54.9	14.9	3.0	3,262
Average.	....	....	4.2	22.6	54.5	15.6	3.1	3,249

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* Nut Culture in the United States, p. 92.

DISCUSSION OF RESULTS.

It has been found that the nutritive value of all foods, irrespective of their source or kind, depends upon the presence of one or more of four classes of nutrients. These are called protein (nitrogenous matter), fats, carbohydrates and ash (mineral matter). The gluten of wheat, the lean of meat, the white of an egg and the curd of milk (casein), are all familiar illustrations of protein. These matters differ from other food constituents in that they contain nitrogen. Examples of fats are butter (fat of milk), the fat of meat, the oils of plants and seeds, as olive oil, oil of corn, etc. Carbohydrates consist of starch, sugar and allied substances. They make up the greater portion of such foods as potatoes and corn. Ash is the matter left after burning, and so far as nutrition is concerned, consists chiefly of phosphates and chlorides of lime, potash and soda.

Food has in general two distinct uses in the body: one to build up and repair, the other to supply the energy needed to enable the body to do work, maintain its temperature, etc. The living tissues of the body, with the exception of fatty tissues, are built up entirely from protein and ash. Protein can be used by the body as a source of energy, but the fats and carbohydrates are the chief sources of energy under normal conditions. The body cannot create energy, but is dependent upon the potential energy of its food for the work it does. The food yields up its energy to the body by being burned, just as truly as if it were in a furnace under a boiler.

As above stated, protein can be burned by the body as a source of energy. This, however, is wasteful of protein, as energy is much more economically furnished by fats and carbohydrates. Not only are the fats and carbohydrates burned as a source of energy, but being thus oxidized in the body they partially protect the protein of the food and of the body from being burned.

Since the chief use of protein is to build up and repair the animal body, if it were protected so that none of it were oxidized only a small amount of protein would be needed per day for maintenance of the body. As it is, even with an abundance of fats and carbohydrates in the food, quite considerable amounts of protein are daily oxidized. The amount of protein that is consumed in the body increases to some extent with the amount of external work done. From observation in the respiration calorimeter in feeding experiments and in dietary studies, Atwater estimates that a man at medium work uses daily about 4½ ounces of protein (.28 pounds or 125 grams).

The energy of the body is derived from the potential energy of its food, which can conveniently be measured by its fuel value. The calorie is the unit and is the amount of heat necessary to raise one kilogram of water 1° of the centigrade scale. This is very nearly the same as the amount of heat required to raise 4 pounds of water 1° Fahrenheit. The fuel value of foods can be very accurately determined by means of an apparatus termed the calorimeter. For example, the fuel value of a pound of shelled almonds, as given in the table on page 87, is 3,030 calories. This means that if a pound of this substance were burned, the heat given off would be capable of warming four times that number or 12,120 pounds of water 1° F.

The protein, fats and carbohydrates of the food are burned in the body and their value for this purpose can be best expressed in calories. A person remaining quiet in a temperature near that of the body would theoretically only use sufficient energy to perform necessary vital processes, such as digestion and assimilation of food, circulation of the blood, etc. If the temperature of the air is much below that of the body, more nutrients would need to be burned in order to keep the body warm, and if at the same time, exercise were taken or work of any kind done, added potential energy of the food would be needed to perform this. Atwater estimates that a man at medium work uses daily about 3,500 calories of potential energy which must be supplied by the food. The .28 of a pound of protein in the daily ration would furnish about 500 calories of energy; the remaining 3,000 calories must be furnished in the food in the form of fats and carbohydrates.

The food for a day's ration for a man at medium work should, therefore, supply about .28 pounds of protein and 3,500 calories of energy, or at the rate of 125 calories for each .01 pound of protein. The above facts and estimates make it easier to understand the nutritive value of different food materials and will help in discussing the place of nuts as food.

In the following table there is given the condensed results of the analyses of nuts given on pages 72 to 84 of this bulletin:

AVERAGE COMPOSITION OF NUTS.

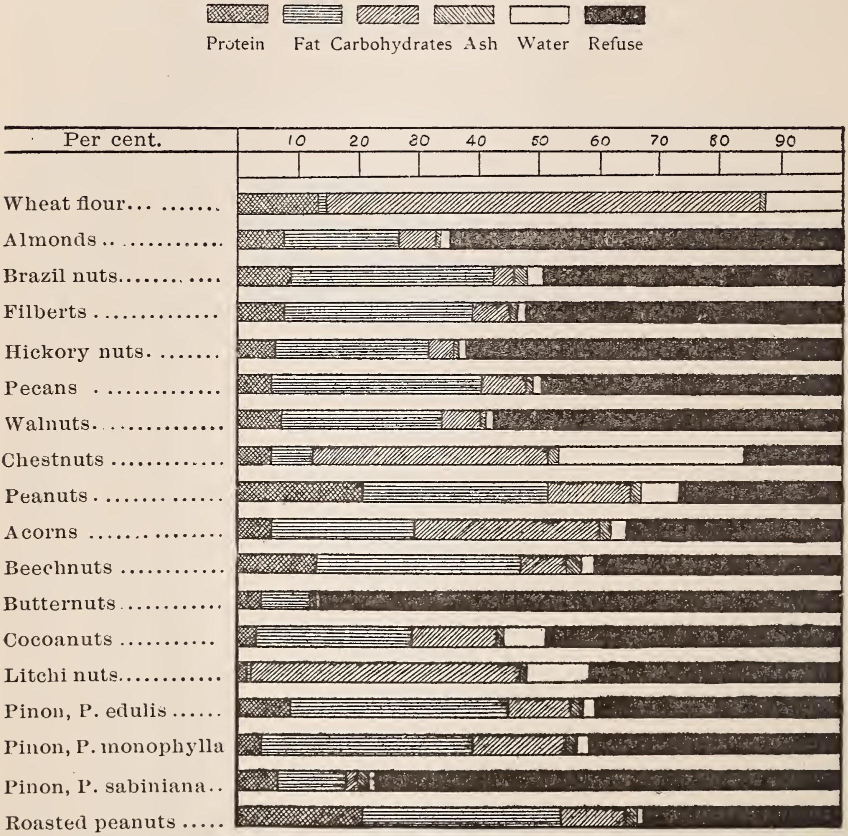
	Number of analyses.	Refuse.	Edible portion.	Edible Portion. Water	Protein.	Fat.	Carbo-hydrates.	Ash.	Fuel value per pound.*
		%	%	%	%	%	%	%	Calories.
Almonds	1	64.8	35.2	1.7	7.3	19.3	6.2	.7	1065
Almonds, kernels	1	.....	100.0	4.8	21.0	54.9	17.3	2.0	3030
Brazil nuts	1	49.6	50.4	2.7	8.6	33.6	3.5	2.0	1545
Filberts	1	52.1	47.9	1.8	7.5	31.3	6.2	1.1	1575
Filberts, kernels	1	.....	100.0	3.7	15.6	65.3	13.0	2.4	3290
Hickory-nuts	1	62.2	37.8	1.4	5.8	25.5	4.3	.8	1265
Pecans	2	49.7	50.3	1.5	5.2	35.6	7.2	.8	1735
Pecans, kernels	2	.....	100.0	2.9	10.3	70.8	14.3	1.7	3445
Walnuts	5	58.0	42.0	1.2	7.0	27.0	6.1	.7	1385
Walnuts, kernels	5	.....	100.0	2.8	16.7	64.4	14.8	1.3	3305
Chestnuts	4	16.1	83.9	31.0	5.7	6.7	39.0	1.5	1115
Acorns	1	35.6	64.4	2.6	5.2	24.1	30.9	1.6	1690
Beechnuts	1	40.8	59.2	2.3	13.0	34.0	7.8	2.1	1820
Butternuts	1	86.4	13.6	.6	3.8	8.3	.5	.4	430
Cocoanuts	1	48.8	51.2	7.2	2.9	25.9	14.3	.9	1415
Cocoanuts, shredded	2	.....	.....	3.5	6.3	57.3	31.6	1.3	3125
Litchi nuts	1	41.6	58.4	10.5	1.7	.1	45.2	.9	875
Pinon, P. edulis	1	40.6	59.4	2.0	8.7	36.8	10.2	1.7	1905
Pinon, P. monophylla	1	41.7	58.3	2.2	3.8	35.4	15.3	1.6	1850
Pinon, P. sabiniana	1	77.0	23.0	1.2	6.5	12.3	1.9	1.1	675
Pistachio, kernels	2	.....	100.0	4.2	22.6	54.5	15.6	3.1	3010
Peanuts, raw	4	26.4	73.6	6.9	20.6	30.7	13.8	1.6	1935
Peanuts, kernels	4	....	100.0	9.3	27.9	42.0	18.7	2.1	2640
Roasted peanuts	1	32.6	67.4	1 1	20.6	33.1	10.9	1.7	1985
Shelled peanuts	1	....	100.0	1.6	30.5	49.2	16.2	2.5	2955
Peanut butter	2	......	......	2.0	29.3	46.6	17.1	†5.0	2830

*Calculated from analysis.

† Including salt, 4.1%.

In the following diagram the composition of the more important of the nuts is shown, compared with the nutrients of a good quality bread flour.

AVERAGE COMPOSITION OF NUTS AS PURCHASED, COMPARED WITH WHEAT FLOUR.



The first six nuts of the table and diagram are common dessert nuts and resemble each other in many respects. As these are found in the market, from 50 to 65 per cent of the unshelled nuts is refuse (shell). Only 35 per cent of the common almond, 40 per cent of the English walnut and about 50 per cent of the filbert, Brazil nut and pecan is edible. All of these six nuts as purchased contain but little water. The protein in the unshelled nuts runs from 5.2 per cent in the pecan, to 8.6 in the Brazil nut, and in the shelled nuts from 10.3 per cent of protein in the pecan, to 21 per cent in the almond. The fats (oils) form the largest part of the edible portion of these nuts varying from 19.3 per cent in unshelled almonds to 35.6 per cent in pecans. The fat in shelled almonds is 55 per cent and in filbert and walnut meats about 65 per cent and in pecans it makes up 70 per cent of the whole. The carbohydrates, which usually predominate in vegetable foods, occur in only small amounts. A pound of mixed nuts would contain about the following amounts of nutrients and potential energy.

APPROXIMATE COMPOSITION OF ONE POUND OF SIX COMMON NUTS.

	Refuse.	Protein.	Fats.	Carbohydrates.	Fuel value.
	Pounds.	Pounds.	Pounds.	Pounds.	Calories.
As purchased	.56	.07	.28	.06	1520
Edible portion	....	.16	.64	.13	3240

A pound of good wheat flour contains about .13 pounds protein, .013 pounds of fat, and .72 pounds of carbohydrates, and has a fuel value of 1,600 calories. The meat of the nuts contains nearly fifty times as much fat, less than one-fifth as much carbohydrates, and has double the fuel value. A pound of unshelled nuts would furnish about half as much protein and about the same amount of potential energy as a pound of flour. The potential energy of the nuts is largely from the fats and that of the flour from carbohydrates. For each .01 pound of protein, flour has 123 calories of potential energy or in nearly the same proportions as that demanded by Atwater's standard for a man at medium work. The nuts have 202 calories for each .01 pound of protein and would not make a well balanced food when eaten by themselves. This unsuitableness for a food by themselves is also increased by the potential energy being stored in the concentrated form of fat. This is no reason, however, why nuts should not fill an increasingly large place in dietaries. Very few foods supply the needed nutrients in the proper proportion to form a well balanced ration. Foods rich in fuel constituents need to be combined with other foods of relatively high protein content. The low per cent of carbohydrates in nuts would seem to fit them as one of the sources of food for diebetic and other persons who find it needful to avoid foods containing much starch or sugar.

The chestnut differs materially from the six nuts we have just considered. While the protein content of the unshelled nut is not very unlike the ordinary table nut, it contains only one-fourth as much fat and six or seven times as much carbohydrates. Indeed its high starch content explains why chestnuts are so little eaten raw. Boiling or roasting causes the starch granules to swell and burst, rendering the nut of easier mastication and giving the digestive juices better opportunity to act upon the ingested nuts. A pound of unshelled chestnuts contains .057 pounds of protein and has a fuel value of 1,115 calories or 195 calories for each .01 pound of protein. This is a somewhat more nearly balanced food than the other nuts. As it yields itself readily to cookery, the chestnut should have a more prominent place in American dietaries.

Although the peanut is not a nut strictly speaking, it deserves special attention because of its composition. A pound of roasted peanuts in the shell has .206 pounds of protein, and a fuel value of 1,985 calories, and a pound of roasted and shelled peanuts carries .305 pounds of protein with a fuel value of 2,955 calories. Peanut butter is apparently ground peanuts and has practically the same composition as roasted and shelled peanuts. Peanuts have a fuel value of only 96 calories for each .01 pound of protein and hence have a relative excess of protein. This is so unlike other vegetable foods, with the exception of the near relatives of the peanut, as peas and beans, that it is of great importance. A bushel of raw peanuts weighs about 22 pounds and costs from 75 cents to $1.25. The roasted peanuts retail at from 5 to 10 cents a quart. A quart of peanuts contains as much protein as one pound of rump steak although, at usual prices, the later costs three times as much.

In this country nuts will never to any great extent replace the cereal foods, as is the case in some sections of the Old World. Not only would the original cost prevent, but the labor involved in shelling and preparing nuts for the table would prove a serious obstacle to their extended use. It will, however, be interesting to compare the relative cost of the different nutrients as furnished by different nuts and by wheat flour at the prices which fairly represent the cost in Maine cities.

AMOUNTS OF NUTRIENTS FURNISHED FOR 10 CENTS IN NUTS AT ORDINARY PRICES.

Nuts as purchased.	Prices per pound.	TEN CENTS WILL PAY FOR—					
		Weight of kernel.	NUTRIENTS.				Fuel value calculated.
			Total.	Protein.	Fats.	Carbo-hydrates.	
	Cents.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Calories.
Almonds	15	.23	.21	.05	.12	.04	675
Brazil nuts	12	.42	.38	.07	.28	.03	1370
Filberts	15	.32	.30	.05	.21	.04	1055
Hickory-nuts *a*	9	.42	.40	.07	.28	.05	1405
Pecans	15	.33	.32	.04	.23	.05	1140
Walnuts	15	.28	.27	.05	.18	.04	925
Chestnuts *b*	8.4	1.00	.62	.07	.08	.47	1340
Peanuts *c*	7.3	1.01	.89	.28	.42	.19	2645
Peanuts *d*	14.6	.50	.44	.14	.21	.09	1320
Wheat flour	3.0	....	2.88	.43	.04	2.41	5450

a At 10 cents per quart, 488 grams.
b At 5 cents per quart, 270 grams.
c At 5 cents per quart, 22 pounds per bushel.
d At 10 cents per quart.

DIGESTIBILITY.

There are no reliable data regarding the digestibility of nuts. The belief in their indigestibility seems to be widespread and perhaps has some basis in fact. It is quite probable that if the nuts were properly prepared and eaten at proper times, much of this prejudice would disappear. Our present practice of munching them at odd hours, or as a dessert, when sufficient food has been taken to meet the requirements of the body, overtaxes the digestive organs and places the nut under a reproach that is at least in part undeserved.

Preparation and Use of Nut Foods.

This subject can be treated here in only a very general way. The first difficulty to be encountered is the removal of the shell. With the peanut this is easily accomplished. With many of our nuts, however, the shell is so hard and tough as to discourage the use of large quantities. Sòme varieties are shelled by machine and the kernels are placed upon the market.

Chestnuts and peanuts when properly prepared furnish palatable and nutritious soups. Peanuts and walnuts, if passed through a meat chopper, or otherwise reduced to a fine state of division, make a butter-like paste which may be used in the preparation of sandwiches. A German dish consists of chestnuts baked with raisins. Salads, croquettes and stuffing for roast fowl may be agreeably diversified by the use of nuts. Commercial preparations of "peanut butter" are on the market and are well received. Desiccated cocoanut is an important article of food. With the exception of the peanut, chestnut and almond, most of the nuts are eaten raw. The nuts, particularly the peanut and chestnut afford interesting opportunities for the housewife skilled in adding to the list of "good things." Attention has been called to the fact that nuts form a very concentrated food. They should, therefore, be eaten with coarser foods and, except in the case of the peanut, with those richer in protein.